NEW SPECIES OF CONEHEAD FROM FLORIDA EVERGLADES (ORTHOPTERA: TETTIGONIIDAE: *NEOCONOCEPHALUS)*[1]

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ABSTRACT: *Neoconocephalus pahayokee* n.sp. resembles *N. lyristes* (Rehn and Hebard) but has a longer cone. *N. lyristes* occurs on the upper Atlantic Coast and in the Midwest and is univoltine. *N. pahayokee* occurs in the Florida Everglades and is bivoltine.

DESCRIPTORS: *Neoconocephalus,* Copiphorinae, Tettigoniidae, disjunct distribution, voltinism

Rehn and Hebard (1915), in the most recent revision of U.S. *Neoconocephalus,* recognized 11 species. Two others have since been added (Walker, Whitesell, and Alexander 1973; Walker and Whitesell 1978). Here we recognize yet another, a previously undescribed species that has been confused with *N. lyristes* (Rehn and Hebard), which in turn has been confused with *N. nebrascensis* (Bruner). The significant history of this compound confusion involves only four publications, discussed in the following four paragraphs.

Rehn and Hebard (1905) described *lyristes* from a single male that they believed had been collected at Chokoloskee, Florida, on the western edge of the Everglades.

Rehn and Hebard (1915) reported numerous additional specimens of *lyristes* from the upper Atlantic Coast (Long Island to southern New Jersey) and none from elsewhere. They noted that the dealer from whom they had purchased the original specimen of *lyristes* had proved "unreliable" and concluded (p. 384) that the type locality of *lyristes* "is extremely questionable, the type having been taken very possibly in the vicinity of New York City and incorrectly labelled."

Blatchley (1920) restored the probable type locality of *lyristes* to south Florida by means of a specimen from Palm Beach. This specimen resembled the type and New Jersey specimens but had (p. 519) "a slightly longer and more slender fastigium." Since Blatchley could not distinguish specimens of *lyristes* from these of the midwestern species *N. nebrascensis* (Bruner), he

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concluded that *lyristes* was but an eastern and southern subspecies of *nebrascensis.*

Thomas (1933) distinguished *lyristes* from *nebrascensis* by habitat, song, and morphology, and reported both in Ohio.

Subsequent authors have confirmed that *lyristes* is distinct from *nebrascensis* (e.g. Alexander, Pace, and Otte 1972), but none has dealt further with the type locality of *lyristes* or with the relationship between the south Florida and the northern U.S. populations of *lyristes*-like coneheads.

Methods

Each month from Sept. 1969 through March 1972, one or both of us traveled to south Florida to obtain specimens, tape recordings, and listening records of crickets and katydids–except Oct. and Dec. 1969, Feb. 1970, and Feb. 1972. We examined specimens of coneheads in the following collections: Florida State Collection of Arthropods, Gainesville (FSCA), University of Michigan Museum of Zoology, Ann Arbor (UMMZ), Academy of Natural Sciences of Philadelphia, and United States National Museum of Natural History, Washington.

Tape recordings were analyzed with an audiospectrograph. Stridulatory areas were removed, glued file-side-up near the end of the left tegmen and examined with a microscope.

Results

Because of morphological and ecological differences, we conclude that south Florida *"lyristes"* is specifically distinct from the upper Atlantic Coast *lyristes* and Midwestern *lyristes*. Because of the similarity of the latter two, we conclude they are conspecific. Morphologically the holotype of *lyristes* belongs to the upper Atlantic Coast populations. We propose that the type locality be fixed as New York City, agreeing with Rehn and Hebard's (1915) contention that the holotype may have come from that vicinity. The northern populations are thus appropriately called *N. lyristes,* and the south Florida populations belong to a species here described as *pahayokee* (the Seminole Indian name for everglades).

Neoconocephalus pahayokee, n.sp.

Everglades Conehead

Diagnosis. Compared with its closest relative, *lyristes,* this species is larger and has a longer cone (Table 1). It is bivoltine and occurs only in subtropical Florida.

Holotype. Male, Florida, Broward Co., jct. U.S. 27 and S.R. 820, 14 Sept. 1968, J.J. Whitesell.

Green except for brown tarsi and hind tibiae, pale yellow lines at lateral edges of pronotal disc and of cone, and black beneath cone. Cone as in Fig. 4 and 5; side of pronotum as in Fig. 9. Specimen is deposited in Academy of Natural Sciences of Philadelphia.

Allotype. Female, same site and deposition as holotype, 15 June 1969, J.J. Whitesell. Similar to holotype except cone slightly curved upward. Ovipositor slightly curved downward.

Measurements (mm). Total length, tip of cone to tip of tegmina, holotype, 59 (range for 31 male paratypes, 54-60), allotype, 67 (female paratype, 65); length of cone, measured as in Fig. 4, 3.6 (3.0-3.5), 4.3 (4.2); medial length of pronotum, 8.5 (7.5-8.4), 7.7 (7.5); length of tegmina, 46 (41-46), 52 (51); length of hind femur, 26 (21-26), 27 (27); length of ovipositor, 32 (29).

Paratypes: 31 ♂ (20 green; 11 brown) 1 ♀ (green); specimens in FSCA unless otherwise indicated. Florida. Broward Co., Fort Lauderdale, 4 Sep. 1925, T.H. Hubbell, 1 ♂ (UMMZ); Fla. Hwy 84, 6.5 mi e. of Andytown, 25 May 1968, TJW, D.L. Mays, JJW, 2 ♂; U.S. Hwy 27 and Fla. Hwy 820, 10 Sep 1969, TJW, JJW, 3 ♂; 10 Oct 1969, JJW, 5 ♂. Dade Co., Everglades Nat. Pk., Fla. Hwy 27, 20 June 1964, TJW, R.E. Love, K.J. Stone, 2 ♂; 21 June 1964, TJW, REL, 3 ♂; 20 mi w. jct. 41, 27, 31 May 1964, Alexander and Hull, 1 ♂, taped RDA 64(23)3, RDA 64(240) (UMMZ); Miami, 23 Apr. 1938, J.W. Cadbury, 1 ♀; 3 mi s. Frog City, Fla. Hwy 27, 23 May 1970, JJW, 7 ♂; 12 July 1970, JJW, 2 ♂; Homestead, 10 Oct. 1970, 1 ♂; jct. U.S. 41, Fla. 27, 23 Apr. 1971, JJW, 1 ♂; 22 Oct. 1971, JJW, 1 ♂. Charlotte Co., 9 May 1957, R.D. Alexander, 2 ♂ (UMMZ).

Geographical distribution. The general distributions of *pahayokee, lyristes,* and *nebrascensis* are shown in Fig. 1. Specific localities for *pahayokee,* other than the ones listed above, are Monroe Co., Fla. Hwy. 94 (TJW listening record), Martin Co., Jonathan Dickinson State Park (Univ. Fla. Tape 188-3), and Palm Beach Co., U.S. Hwy 441 (UFT 188-4). Blatchley's (1920, p. 519) record of a female *"lyristes"* from Palm Beach is also this species.

The Atlantic Coast – Midwest disjunction evident in *lyristes* distribution occurs in other animals and is thought to reflect a migration route via the Hudson and Mohawk Valleys that opened for grass-inhabiting species during a postglacial warm period (Thomas 1933), Gene flow between the two areas now occupied by *lyristes* must be nearly nil, but specimens from the two areas are sometimes indistinguishable.

Habitat and seasonal cycle. The principal habitat of *pahayokee* is the sawgrass (*Cladium jamaicense* Crantz) that dominates the Florida Everglades. Nearly all specimens were collected by homing on their songs. Some were on tall sawgrass emergent from at least two feet of water; others were on new growth in recently burned, still-dry areas. Occasionally males were heard away from sawgrass – e.g. beneath a streetlight in Homestead and 10 m up a

Caribbean pine in Joanthan Dickinson State Park.

N. pahayokee is apparently bivoltine with a spring generation of adults peaking in May-June and a fall generation in Sept.-Oct. The earliest and latest records for the spring generation are 23 Apr. and 12 July; for the fall generation, 4 Sep. and 22 Oct. Since we made monthly field trips to south Florida for more than two years, the lack of records of adults during winter and mid summer is noteworthy and not an artifact of sporadic sampling. *N. lyristes* is univoltine with adults occurring from early August until mid October.

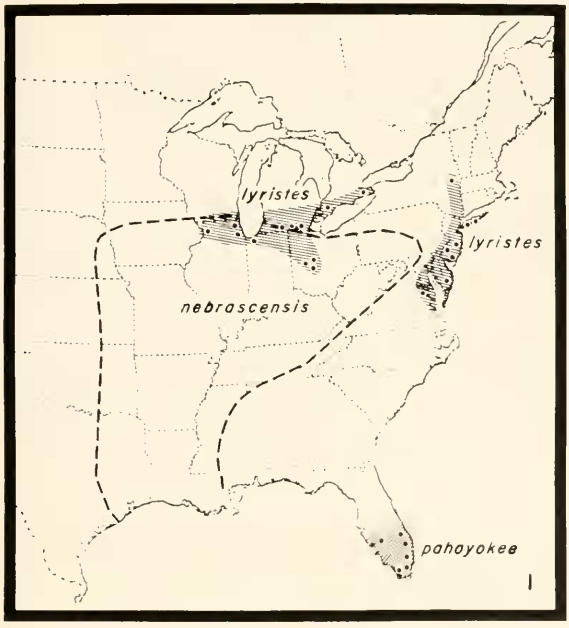
Brown-green color dimorphism in *pahayokee* differed in the two generations. Of 22 males captured or seen in the spring generation, 19 were green and 3 were brown; of 18 in the fall, 6 were green and 12 were brown. The spring generation had a significantly higher proportion of the green morph than did the fall generation (chi square; $P < 0.001$). Brown-green/dimorphism may be maintained by apostatic selection (Allen and Clark 1968). The differences in proportion of brown and green between generations may be triggered by photoperiod (Dolling 1973, Whitesell 1974) and result in the more cryptic form being prevalent each generation – the green form when the grass is young and green and the brown form when the grass is old and browning.

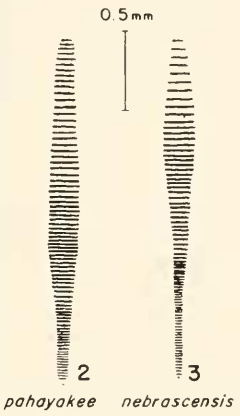
Song. The calling songs of *pahayokee* and *lyristes* are high-pitched, smooth, continuous buzzes. Those of *pahayokee* average aboue 155 pulses per second at 23°C with a dominant frequency of 10-11 kHz (n=9). Alexander (1956) found the song of an Ohio specimen of *lyristes* at 23°C to be 130 per second and 7.5 kHz. No tape recordings of eastern *lyristes* were available for analysis.

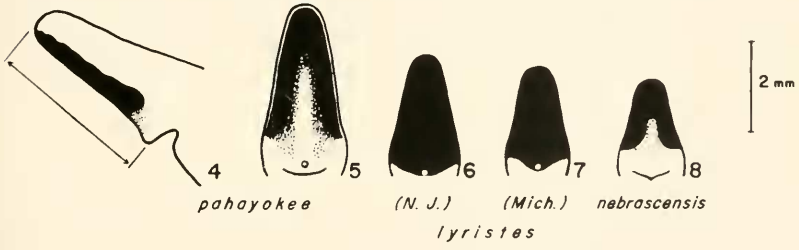
Morphology. Measurements of *pahayokee* and *lyristes* are summarized in Table 1. The shortest cone among males of *pahayokee* (n=32) was 3.0 mm; the longest among males of *lyristes* (n=15, N.J.) was 2.8 mm. Corresponding values for females (n=2 and 3) were 4.2 and 3.3 mm.

N. pahayokee (Fig. 9) and *lyristes* are similar in the shape and depth of the tegminal sinus of the pronotum but different from *nebrascensis* (Fig. 10).

The stridulatory files of *pahayokee* (n=3), *lyristes* (n=2, N.J.) and *nebrascensis* (n=5, Ind., Miss., Tenn., Pa.) cannot be distinguished by number of teeth or length: 84-92 teeth in 2.22-2.34 mm; 85 and 89 teeth in 2.28 and 2.34 mm; 81-89 teeth in 2.10-2.26 mm respectively. However, the spacing of the first 10-15 teeth at the lateral end of the stridulatory file is conspicuously wider than of subsequent teeth in *nebrascensis* (Fig. 3) but not in *pahayokee* (Fig. 2) or *lyristes.*







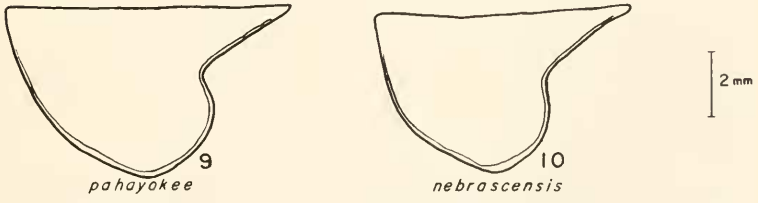


Fig. 1. Distribution of three species of *Neoconocephalus*. Shaded areas represent predicted general distribution and dots represent county records for *N. lyristes* and *N. pahayokee*. Dashed line encloses all records for *N. nebrascensis*. Fig. 2-3. Ventral views of stridulatory files of males (lateral ends above, mesal ends below). Fig. 4-8. Cones. Fig. 4. Method of measuring length, lateral view. Fig. 5-8. Ventral views. Fig. 9-10. Left lateral views of pronotums. Fig. 4, 5, 9. Holotype of *N. pahayokee*.

Table 1. Lengths in mm of selected structures of *N. pahayokee* and *lyristes*.

Species (locality)	n	Cone $\bar{x} \pm SD$	Tegmen $\bar{x} \pm SD$	Hind Femur $\bar{x} \pm SD$	Ovipositor range
pahayokee (Florida)					
males	10	3.2 ± 0.2	44 ± 2	25 ± 1	
females	2	4.2	52	27	29-32
lyristes (Upper Atlantic Coast)					
holotype (N.Y.?)	1	2.5	40	21	
males (N.J.)	10	2.5 ± 0.3	41 ± 3	22 ± 1	
females (N.J.)	3	3.3	47	24	26-29
lyristes (Ind. Mich.)					
males	10	2.1 ± 0.3	36 ± 2	20 ± 1	

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